TECHNICAL SUPPORT DOCUMENT
FOR THE
SECOND TIER ANALYSIS
SIERRA PACIFIC INDUSTRIES
LUMBER PRODUCTION INCREASE
ABERDEEN, WASHINGTON
October 29, 1007

1.0 EXECUTIVE SUMMARY

Proposed formaldehyde emissions from the drying of lumber at Sierra Pacific's Mill near Aberdeen, Washington exceed a regulatory trigger level called an Acceptable Source Impact Level (ASIL).

On the basis of the Second Tier analysis described here and the modeled formaldehyde concentrations, the Washington State Department of Ecology (Ecology) has determined the health risks are within the range that Ecology may approve for proposed new sources of Toxic Air Pollutants (TAP) under Chapter 173-460 Washington Administrative Code (WAC).

Below is the technical analysis performed by Ecology.

2.0 BACKGROUND

2.1 The Regulatory Process

The requirements for performing a toxics screening are established in Chapter 173-460 WAC. These rules require a review of any increase in toxic emissions for all new or modified stationary sources in the State of Washington.

2.2 The Three Tiers of Toxic Air Pollutant Permitting

There are three levels of review when processing a new or modified emissions unit emitting Toxic Air Pollutants (TAP's): (1) Tier One (toxic screening), (2) Tier Two (health impacts assessment), and (3) Tier Three (risk management decision).

All projects are required to undergo a toxic screening (Tier One analysis) as required by WAC 173-460-040. The objective of the toxic screening is to establish the systematic control of new sources emitting toxic air pollutants in order to prevent air pollution, reduce emissions to the extent reasonably possible, and maintain such levels of air quality as will protect human health and safety. If modeled emissions exceed the trigger levels called ASIL's, a Second Tier analysis is performed.

A Second Tier analysis, promulgated in WAC 173-460-090, is a site-specific health impacts assessment. The objective of a Second Tier analysis is to quantify the increase in lifetime cancer risk for persons exposed to the increased concentration of any Class A TAP and to quantify the

increased health hazard from any Class B TAP in ambient air that would result from the proposed project. Once quantified, the cancer risk is compared to the maximum risk allowed by a Second Tier analysis, which is one in one hundred thousand, and the concentration of any Class B TAP that would result from the proposed project is compared to its effect threshold concentration.

If the emissions of a toxic pollutant result in a cancer risk of greater than one in one hundred thousand then an applicant may request Ecology perform a Tier Three analysis. A Tier Three is basically a risk management decision in which the Director of the Department of Ecology makes a decision that the risk of the project is acceptable based on determination that emissions will be maximally reduced through available preventive measures; assessment of environmental benefit, disclosure of risk at a public hearing and related factors associated with the facility and the surrounding community.

2.3 Processing Requirements

Ecology shall evaluate a source's Second Tier analysis only if:

- The authority has advised Ecology that other conditions for processing the notice of construction have been met,
- Emission controls contained in the conditional notice of construction represent at least Best Available Control Technology for Toxics (T-BACT), and
- Ambient concentrations exceed acceptable source impact levels after using more refined emission quantification and air dispersion modeling techniques.

ORCAA submitted the three items listed above to Ecology on August 16, 2007.

2.3.1 Authority's Activities

The Olympic Region Clean Air Agency (ORCAA) received the application on December 1, 2007. ORCAA determined the application complete on June 1, 2007. A draft Notice of Construction (NOC) permit was provided to Ecology on August 16, 2007.

2.3.2 T-BACT Verification

T-BACT is required for any new or modified emission unit that has an increase in emissions of toxic air pollutants. While the lumber kilns are not undergoing a physical modification, they are undergoing a change in the method of operation. Ecology has reviewed the T-BACT analysis performed by ORCAA.

2.3.3 Ambient Concentrations of Toxic Air Pollutants

Ecology reviewed the application and verified the emission estimates. Emissions of terpene (while being greater than the Small Quantity Emissions Rate Tables (SQER)) are not subject to a

Second Tier analysis. Emissions of formaldehyde exceed the ASIL and a Second Tier analysis must be performed.

2.4 The Project

2.4.1 Permitting History

The Sierra Pacific Lumber mill was designed and permitted in 2002. A NOC permit was issued by ORCAA to establish a lumber mill with planer, dry kilns and a package boiler (01NOC192) on May 8, 2002.

On December 19, 2002, ORCAA issued a NOC permit for an in-line contained anti-mold spray system on (02NOC268).

On May 1, 2004, ORCAA issued a NOC permit for an eighth lumber kiln (04NOC347).

On February 2, 2005, ORCAA issued a NOC for the replacement of a baghouse (04NOC392).

On September 29, 2006, ORCAA issued a NOC permit for a new double-track dry kiln (ninth lumber kiln) and an increase total production capacity of dried, dimensional lumber from 216 million board feet per year (MMbf/yr) to 315 MMbf/yr.

2.4.2 The Proposed Project

Sierra Pacific has proposed to modify their method of operation of their lumber kilns by increasing their lumber production from 216 Million board feet per year (MMbf/yr) to 400 MMbf/yr. In addition, the temperature of the kilns will be raised from 180^0F to 200^0F. Because this project is being proposed so soon after the ninth kiln project, this analysis incorporates the emissions from both projects.

2.4.3 Site Description

The sawmill is located at 301 Hagara Street, Aberdeen, Washington on the east bank of the Chehalis River. It is 2.5 kilometers due east of the Aberdeen, Washington city limits, directly east across the river from South Aberdeen, Washington, and about 100 meters west of the community of Junction City. The property is a rough rectangle, 350 meters wide (east west) by 800 meters long (north south). The site of the proposed project is within a Class II area that is in attainment or unclassified with regard to all pollutants regulated by the National Ambient Air Quality Standards (NAAQS) and state air quality standards. The Mill is located on the western portion of Section 11, Township 17 North, Range 9 West Willamette Meridian. The site address is 301 Hagara Street, Aberdeen, Washington 98520. This location is in census tract 800 of Grays County (U.S. Census Bureau, 2000).

2.4.4 Emissions

Sierra Pacific has estimated its emissions of formaldehyde from the new ninth kiln, the increase in temperature, and the increased throughput to be 403 pounds per year. The table below compares the emissions of formaldehyde and terpene to the Small Quantity Emission Rates (SQER) (see WAC 173-460-080). ORCAA disagreed with the emission factor proposed by Sierra Pacific for formaldehyde and selected a larger one (0.00219 vs. 0.00158 lb/Million board feet per year (MMbf/yr) because the Sierra Pacific emission factor was obtained by taking the arithmetic mean of four data points from the paper's raw data section. ORCAA rejected SPI's emission factor because it only took temperature and not initial moisture content into consideration. The revised emission factor for formaldehyde results in an increase of 660 pounds per year.

Pollutant	CAS No.	Emission Factor (lb/Mbf)		Emission Rate				Difference Post - Pre		SQER		Over SQER Y or N?
				Pre [1]modification		Post [2]modification				lb/hr	lb/yr	
		Old EF	New EF[4]	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr[3]			
Formaldehyde	50-00-0	0.001	0.00219	0.025	216	0.1	876	N/A	660	N/A	20	**Y**
Terpene	80-56-8	0.32	0.32	7.89	69,120	14.61	128,000	7.9	69,120	5.0	43,748	**Y**

2.4.5 Point of Compliance

Assessment of potential health risks from the project were based on the maximum modeled concentration of formaldehyde and terpene at an assumed point of public exposure (nearest point of ambient air) 574 feet away (175 meters). The distance to the maximum concentration is 590 feet (180 meters) and the distance to the closest residential receptor is 673 feet (205 meters).

2.4.6 Emission Concentrations

Below are the modeling results of the pollutants that exceeded the Small Quantity Emission Rates compared to the ASIL's.

Pollutant	Emission Factor (lb/Mbf)	Closest Point of Ambient Air (175 m) ($\mu g/m^3$)	Highest Concentration (180 m) ($\mu g/m^3$)	Residence (205 m) ($\mu g/m^3$)	ASIL ($\mu g/m^3$)
Formaldehyde	0.00219	0.49	0.64	0.56	0.0770000[5]
Terpene	0.32	107	140	122.5	1,900[6]

2.4.7 Pollutants Subject to Second Tier Analysis

Emissions of terpene are below the ASIL after being modeled for all three points (closest, highest concentration, and closest residence) therefore the only pollutant subject to review under the Second Tier analysis is formaldehyde.

2.4.8 Background Emissions

Background emissions were established based on the United States Environmental Protection Agency's (USEPA) National-scale Air Toxic Assessments (NATA).[7] The USEPA used a

[1] Pre modifications based upon 216 MMbf/yr.
[2] Post modification emissions based upon 400 MMbf/yr.
[3] Example calculation for formaldehyde (400-216)*1000*0.00219 + 216*1000*(0.00219-0.001) = 660 lb/yr.
[4] The new emission factor was not used to calculate the old emissions because of the change in drying temperature.
[5] Annual average.
[6] 24-hr average.

computer dispersion simulation model to estimate the ambient toxic air pollutant concentrations reported in the NATA called the Assessment System for Population Exposure Nationwide (ASPEN).[8]

ASPEN Grays Harbor County 1999 annual average formaldehyde concentration estimates.

Source Category	Background ($\mu g/m^3$)
Major	0.001751781
Area and Other[9]	0.074093125
On-road[10]	0.046477063
Non-road[11]	0.051070125
Background[12]	0.54959465
Total	0.72298674299

[7] EPA's ongoing comprehensive evaluation of air toxics in the U.S. These activities include expansion of air toxics monitoring, improving and periodically updating emission inventories, improving national- and local-scale modeling, continued research on health effects and exposures to both ambient and indoor air, and improvement of assessment tools.

[8] The ASPEN model takes into account important determinants of pollutant concentrations, such as: rate of release, location of release, the height from which the pollutants are released, wind speeds and directions from the meteorological stations nearest to the release, breakdown of the pollutants in the atmosphere after being released (i.e., reactive decay), settling of pollutants out of the atmosphere (i.e., deposition), and transformation of one pollutant into another (i.e., secondary formation).

[9] Area and other sources include sources that generally have smaller emissions on an individual basis than "major sources" and are often too small or ubiquitous in nature to be inventoried as individual sources. "Area sources" include facilities that have air toxics emissions below the major source threshold as defined in the air toxics sections of the Clean Air Act and thus emit less than 10 tons of a single toxic air pollutant or less than 25 tons of multiple toxic air pollutants in any one year. Area sources include smaller facilities, such as dry cleaners. "Other sources" include sources such as wildfires and prescribed burnings that may be more appropriately addressed by other programs rather than through regulations developed under certain air toxics provisions (section 112 or 129) in the Clean Air Act.

[10] On-road mobile sources are vehicles found on roads and highways (e.g., cars, trucks, buses).

[11] Non-road mobile sources are mobile sources not found on roads and highways (e.g., airplanes, trains, lawn mowers, construction vehicles, farm machinery).

[12] In the context of the NATA, EPA uses the term “background” concentrations to mean the contributions to outdoor air toxics concentrations resulting from natural sources, persistence in the environment of past years' emissions and long-range transport from distant sources.

2.5 T-BACT

Best Available Control Technology for Toxics (T-BACT) is required for any new or modified emission unit that has an increase in emissions of toxic air pollutants. While the lumber kilns are not undergoing a physical modification they are undergoing a change in the method of operation. ORCAA has performed a T-BACT analysis on the kilns. They have determined that T-BACT for controlling emissions of formaldehyde from lumber kilns to be operating a computerized steam management system and a maximum drying temperature of 200 ºF or lower. Ecology reviewed their conclusion and concurs with the ORCAA T-BACT determination.

2.6 Air Dispersion Modeling

Although the application was submitted at the end of the changeover period for accepting analyses based on ISC models, modeling using ISC was allowed for this project because the applicant had recently used this model for an activity at this facility. This was reviewed by Ecology's senior modeler. The Aberdeen-Bryant site was selected for its meteorology because it captures the important aspects of the up-valley/down-valley circulation affecting the mill emissions. Source emission point release parameters indicated that nearby buildings would exert a significant influence on emissions from the new kiln and would require the use of a model incorporating the PRIME downwash algorithm.

Use of the single year of meteorology from the nearby Aberdeen-Bryant site was preferred over multiple years from the more distant Hoquiam Bowerman Field airport because of the importance in accurately characterizing the wind speed and direction in the vicinity of the Sierra Pacific facility.

The maximum concentrations were obtained by using ISCPRIME, which was an approved EPA model at the time the application was submitted.

2.7 Health Impacts Assessment

A health impacts assessment was prepared by the applicant and was reviewed and approved by Ecology. A team of people were assigned to this project consisting of an engineer, a toxicologist and a modeler.

Below are descriptions of the content of each part of the Health Impacts Assessment.

2.7.1 Hazard Identification

Hazard identification involves gathering and evaluating toxicity data on the types of health injury or disease that may be produced by a chemical and on the conditions of exposure under which injury or disease is produced. It may also involve characterization of the behavior of a chemical within the body and the interactions it undergoes with organs, cells, or even parts of cells. This information may be of value in determining whether the forms of toxicity known to be produced

by a chemical agent in one population group or in experimental settings are also likely to be produced in human population groups of interest. Note: Risk is not assessed at this stage; hazard identification is conducted to determine whether and to what degree it is scientifically correct to infer that toxic effects observed in one setting will occur in other settings (i.e., are chemicals found to be carcinogenic or teratogenic in experimental animals also likely to be so in adequately exposed humans?).

2.7.2 Identification of Potentially Exposed Populations

This step involves describing the nature and size of the various populations exposed to a chemical agent in the vicinity of the proposed project.

2.7.3 Discussion of TAP Concentrations

This step involves the identification of the toxicological profiles of all toxic air pollutants that exceed the ASIL. It includes a discussion of the toxicological effects of hazardous substances, chemicals, and compounds. Each profile includes an examination, summary, and interpretation of available toxicological and epidemiological data evaluations on the hazardous substance

2.7.4 Exposure Assessment

This step includes characterization of exposure pathways, and total daily intake based on the magnitude and duration of exposure to toxic air pollutants that exceed the ASIL from these pathways. The evaluation could include past exposures, current exposures, or exposures expected in the future.

2.7.5 Risk/Hazard Assessment

This step involves the integration of data analyses from each step of the risk assessment to determine the likelihood that the human population of interest will experience any of the various forms of toxicity associated with a chemical under its known or anticipated conditions of exposure.

2.7.6 Uncertainty

In almost all risk assessments undertaken in support of regulatory decisions, especially in regard to chronic hazards, risk assessors are required to go beyond available data and make inferences about risks expected for conditions of exposure under which direct evidence of risk cannot now be collected. When scientific uncertainty is encountered in a risk assessment, the integration of any assumptions is required to fill information gaps. The following are examples of components that constitute significant gaps in the scientific basis for assessing human cancer risk.

- How relevant is the data to humans?
- How relevant to humans are results from animal studies using a different route of exposure?

- How relevant are results from studies using an exposure regimen (in terms of frequency and duration) that differs from the human situation?
- Which species/strains of animals are most appropriate fore dose response assessment in humans?
- How should risk estimates be developed?
- Using most sensitive species/strain/sex?
- Combining incidents of benign and malignant tumors?
- Using pooled tumor incidence (tumor bearing animals)?
    - Can results of an animal study that does not extent over a lifetime be extrapolated to lifetime?
- How does the dose-response relation relate to the unobservable dose-response relation in the dose region of concern for the human population under study?
- How should low-dose risk be modeled?
- Do agents operate by threshold or non-threshold mechanisms?

3.0 HEALTH IMPACTS ASSESSMENT

3.1 Introduction

The Second Tier analysis described below was conducted according to the requirements promulgated in Chapter 173-460 WAC. It was reviewed by Ecology's senior toxicologist. It addressed the public health risk associated with exposure to the formaldehyde emissions from the drying of wood in the health effects assessment prepared by the consultant (Geomatrix) for Sierra Pacific.

3.2 Hazard Identification

Formaldehyde is a colorless gas with a pungent, suffocating odor at room temperature. The odor threshold for formaldehyde is 0.83 ppm. Formaldehyde is readily soluble in water at room temperature. Its chemical formula is HCHO and the molecular weight is 30.03 g/mol. The vapor pressure for formaldehyde is 1.3 mm Hg at 20 ^{0}C, and its log octanol/water partition coefficient (Log K_{ow}) is -0.65. Formaldehyde has a boiling point of 75 ^{0}F and it is not combustible. Formaldehyde exposure can lead to acute, chronic, and reproductive effects.

Acute Effects:

- The major toxic effects caused by acute formaldehyde exposure via inhalation are eye, nose, and throat irritation and effects on the nasal cavity.
- Other effects seen from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains, and bronchitis.
- Ingestion exposure to formaldehyde in humans has resulted in corrosion of the gastrointestinal tract and inflammation and ulceration of the mouth, esophagus, and stomach.

- Acute (short-term) animal tests, such as the LC_{50} and LD_{50} tests in rats and rabbits have shown formaldehyde to have high acute toxicity from inhalation, oral, and dermal exposure.

Chronic Effects (Noncancer):

- Chronic exposure to formaldehyde by inhalation in humans has been associated with respiratory symptoms and eye, nose, and throat irritation.
- Repeated contact with liquid solutions of formaldehyde has resulted in skin irritation and allergic contact dermatitis.
- Animal studies have reported effects on the nasal respiratory epithelium and lesions in the respiratory system from chronic inhalation exposure to formaldehyde.
- The RfD for formaldehyde is 0.2 mg/kg/d based on a decrease in bodyweight gain and effects on the stomach in rats.
- EPA has high confidence in the study on which the RfD was based since it consisted of an adequate number of animals of both sexes, as well as a thorough examination of toxicological and histological parameters; medium confidence in the database as several additional chronic bioassays and reproductive and developmental studies support the critical effect and study; and, consequently, medium confidence in the RfD.
- EPA has not established an RfC for formaldehyde.

Reproductive/Developmental Effects:

- An increased incidence of menstrual disorders and pregnancy problems were observed in women workers using urea-formaldehyde resins. However, possible confounding factors were not evaluated in this study.
- A study of hospital equipment sterilizing workers did not report an association between formaldehyde exposure and increased spontaneous abortions.
- Developmental effects, such as birth defects, have not been observed in animal studies with formaldehyde.

Cancer Risk:

- Occupational studies have noted statistically significant associations between exposure to formaldehyde and increased incidence of lung and nasopharyngeal cancer. This evidence is considered "limited," rather than "sufficient," due to possible exposure to other agents that may have contributed to the excess cancers.
- Animal studies have reported an increased incidence of nasal squamous cell carcinomas by inhalation exposure.
- EPA considers formaldehyde to be a probable human carcinogen (cancer-causing agent) and has ranked it in EPA's Group B1. The International Agency for Research on Cancer (IARC) has also concluded formaldehyde *is probably carcinogenic to humans (Group 2A).*
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of 1.3×10^{-5} $(\mu g/m^3)^{-1}$.

> EPA estimates that, if an individual were to breathe air containing formaldehyde at 0.08 µg/m^3 over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.8 µg/m^3 would result in approximately a one-in-a-hundred thousand increased chance of developing cancer, and air containing 8.0 µg/m^3 would result in approximately a one-in-ten-thousand increased chance of developing cancer.

TERRESTRIAL FATE: When released on soil, aqueous solutions containing formaldehyde will leach through the soil. While formaldehyde is biodegradable under both aerobic and anaerobic conditions, its fate in soil is unknown.

AQUATIC FATE: When released into water, formaldehyde will biodegrade to low levels in a few days. Little adsorption to sediment would be expected to occur. In nutrient-enriched seawater, there is a long lag period (approximately 40 hr) prior to measurable loss of added formaldehyde by presumably biological processes. Its fate in groundwater is unknown.

ATMOSPHERIC FATE: Formaldehyde is released to the atmosphere in large amounts and formed in the atmosphere by the photo oxidation of hydrocarbons. This input is counterbalanced by several important removal paths. It both photolyzes and reacts rapidly with reactive free radicals, principally hydroxyl radicals, which are formed in the sunlight-irradiated atmosphere. The half-life in the sunlit troposphere is a few hours. Reaction with nitrate radicals, insignificant during the day, may be an important removal mechanism at night. The initial oxidation product, formic acid, is a component of acid rain. Because of its high solubility, there will be efficient transfer into rain and surface water which may be an important sink. One model predicts dry deposition and wet removal half-lives of 19 and 50 hr, respectively. Although formaldehyde is found in remote areas, it is probably not transported there, but rather a result of the local generation of formaldehyde from longer-lived precursors, which have been transported there.

3.3 Identification of Exposed Populations

Sierra Pacific is located in a semi-rural area. The population of Aberdeen in the year 2000 was 16,461 with an estimated 0.6 percent decline through 2005. The median age of the residents is 34.9 with 7.5 percent under five years, 73.2 percent over 18 years of age, and 14.0 percent 65 years or older. The percentage of small children is slightly higher than the national average of 6.8 percent. Six public elementary schools, one private K-8 school, one junior high school, and two high schools are located in Aberdeen. There is one elementary school located in Cosmopolis. All the schools are within three miles of the facility, and the closest school (Stevens Elementary School) is less than a mile from the facility. The Grays Harbor Community hospital is approximately three miles from the facility. Other sensitive receptors include retirement and child care facilities and are located one mile east of the facility in Aberdeen. The table below gives the distances and concentrations of formaldehyde at those receptors (annual average):

Receptor	Distance		Modeled Concentration ($\mu g/m^3$)
	Miles	Kilometers	
Schools			
A J West School	3.0	4.8	0.004
Alexander Young Elementary School	3.0	4.8	0.006
Central Park Elementary School	3.6	5.9	0.018
Cosmopolis Elementary School	1.3	2.1	0.008
Grays Harbor Christian School	2.2	3.5	0.004
Grays Harbor College	1.9	3.0	0.013
Grays Harbor Seventh Day Adventist School	3.7	6.0	0.003
Hopkins Junior High School	2.7	4.4	0.004
JM Weatherwax High School	2.3	3.6	0.004
McDermoth Elementary School	2.3	3.8	0.004
Miller Junior High School	2.2	3.6	0.005
Schools Continued			
Robert Gray Elementary School	2.0	3.1	0.002
Saint Mary's School	2.2	3.5	0.04
Stevens Elementary	0.8	1.2	0.031
Washington School	1.3	2.2	0.016
Whitman School	1.5	2.5	0.008
Hospitals			
Children's Hospital & Regional Medical Center	3.4	5.5	0.006
Grays Harbor Community Hospital	3.5	5.6	0.005
Peninsulia Community Health Service	3.1	4.9	0.003
Child Care			
A Bundle of Joy Day Care	2.9	4.7	0.007
Brenda's Family Day Care	3.3	5.3	0.024
Calvary Lutheran Church	3.5	5.7	0.003
Great Beginning Child Care	1.9	3.1	0.002
Kid's Place Daycare	4.0	6.4	0.016
Wunderland Childcare Center	3.1	5.0	0.004

Receptor	Distance		Modeled Concentration ($\mu g/m^3$)
	Miles	Kilometers	
Wunderland Childcare Extension	1.9	3.0	0.005
Wunderland Childcare Center II	3.0	4.8	0.004
Retirement/Nursing			
Hidden House Adult Family Home	3.5	5.6	0.003
Home Care Center Inc.	2.6	4.2	0.006
Westhaven Villa	3.5	5.7	0.005
Government			
Grays Harbor Juvenile Court Facility	0.6	1.0	0.002

3.4 Discussion of TAP Concentrations

As shown above, the concentration of formaldehyde at the closest point of ambient air, the highest concentration, and the nearest receptor are:

Pollutant	Emission Factor (lb/Mbf)	Closest Point of Ambient Air (175 m) ($\mu g/m^3$)	Highest Concentration (180 m) ($\mu g/m^3$)	Residence (205 m) ($\mu g/m^3$)	ASIL (annual average) ($\mu g/m^3$)
Formaldehyde	0.00219	0.49	0.64	0.56	0.0770000

3.5 Exposure Assessment (daily intake & risk)

Geomatrix sufficiently characterized existing pathways and total daily intake for formaldehyde; There is no appreciable pathway for SPI's formaldehyde emissions to enter drinking water systems in the Grays Harbor County area; therefore, exposure pathways are limited to skin contact and direct inhalation. Further, no data on formaldehyde ingestion or skin contact exposure for people living in the area is available. Therefore, total daily formaldehyde intake was assumed to be entirely through inhalation.

Location	Modeled concentration ($\mu g/m^3$)	Background concentration ($\mu g/m^3$)	Total ($\mu g/m^3$)
Closest Point of Ambient Air (175 m)	0.49	0.72	1.21
Highest Concentration (180 m)	0.64	0.72	1.36
Residence (205 m)	0.56	0.72	1.28

3.6 Risk/Hazard Assessment

The formula for determining risk is as follows: Risk = C_{Air} x URF

Where C_{Air} is Concentration in air at the receptor ($\mu g/m^3$).

And URF is Unit Risk Factor for formaldehyde (6.0×10^{-6} $(\mu g/m^3)^{-1}$). This factor comes from the California Office of Environmental Health Hazard Assessment (OEHHA) database.

Location	Distance meters	C_{Air} ($\mu g/m^3$)	URF[13] $(\mu g/m^3)^{-1}$	Risk ($\mu g/m^3$)
Point of closest ambient air	175	1.21	6.0×10^{-6}	7.3×10^{-6}
Point of maximum concentration	180	1.36	6.0×10^{-6}	8.2×10^{-6}
Point of closest residential receptor	205	1.28	6.0×10^{-6}	7.7×10^{-6}

As you can see, the risk from this proposed modification is less than 1×10^{-5} or 1 in 100,000.

3.7 Uncertainty Characterization

To the extent that an individual will be exposed to emissions of formaldehyde from this proposed project the applicant submitted the following uncertainty analysis:

- Tap emission rates have been estimated using an emission factor that is significantly higher than the older factor. Based upon the information available today, Ecology believes that it is unlikely that the formaldehyde emissions are under estimated.
- The air dispersion model used, while not the most current model available it is likely that the model did not drastically underestimate the emissions of formaldehyde from the proposed modification.

3.8 Length of Exposure

With no evidence to the contrary provided to us, Ecology is forced to assume that people located at the point of concern (the nearest residence) may be exposed to mill emissions continuously for most of their lives. Since no one is reasonably expected to spend a significant part of their life at the "Closest Point of Ambient Air" or other nearby locations, outside the nearest residence, we assume cumulative exposure will be significantly less than life-long duration for persons entering the emissions impact zone.

[13] Background is 0.451-$\mu g/m^3$. Using this background the risk from background alone is 5.9×10^{-6}.

4.0 CONCLUSION

The project will not have a significant adverse impact on air quality. The Washington State Department of Ecology finds the applicant, Sierra Pacific, has satisfied all requirements for Second Tier analysis.

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5.0 LIST OF ABBREVIATIONS

ASIL	Acceptable Source Impact Level
BACT	Best Available Control Technology
BTU	British Thermal Unit
CFR	Code of Federal Regulations
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
HAP	Hazardous Air Pollutant
hr	Hour
IARC	The International Agency for Research on Cancer
MBtu/hr	Thousand British Thermal Units per Hour
MMBtu/hr	Million British Thermal Units per Hour
NATA	National-scale Air Toxic Assessments
NOC	Notice of Construction
OEHHA	California Office of Environmental Health Hazard Assessment
ORCAA	The Olympic Region Clean Air Agency
PTE	Potential to Emit
SQER	Small Quantity Emission Rates
TAP	Toxic Air Pollutant
T-BACT	Best Available Control Technology for Toxics
tpy	Tons per Year
VOC	Volatile Organic Compounds
WAC	Washington Administrative Code
yr	Year